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Saperda puncticollis Say.—Breeds in poison-ivy (*Rhus toxicodendron*).

Mecas inornata Say.—Bores in the roots and lower part of the stems of *Helenium tenuifolium*, also recorded as living in the shoots of willow and poplar.

Oberea bimaculata Oliv.—Burrows in the stems of blackberry and raspberry.

Oberea schaumii Lec.—Larva bores in the twigs of cottonwood (poplar).

Oberea mandarina Fabr.—Bores in the twigs of poplar.

Oberea quadricallata Lec.—Lives in the stems of willow.

Tetraopes tetraophthalmus Forst.—The larva bores in the roots and lower parts of the stem of milkweed (*Asclepias*). The larvæ of the other species of the genus probably also live in a similar manner.

Dysphaga tenuipes Hald.—Breeds in dead limbs of hickory.

NOTE ON GEOGRAPHICAL DISTRIBUTION AND MIMICRY OF APATELA.

By A. RADCLIFFE GROTE, A. M.

The majority of the species of *Apatela* occur in North America, where their range is extraordinarily extended, since they are found from Hudson's Bay territory in the north to the tropical regions in Mexico; they appear to be absent from the West Indies. From North America, north of Mexico, sixty species are described, the European fauna has a total of fifteen (consult Grote, *Die Verwandtschaft zwischen der Noc-tinden-Fauna von Nordamerika und Europa*, *Gerhandl. Gesell. Deutsch. Naturf. und Aerzte*, Bremen, 1890). A surprising number of species have been collected in Bastrop Co., Texas, by Belfrage; from this State twelve species are recorded. From California only four species are certainly known, *perdita*, *spinea*, *lupini*, *felina*; the last is, according to Dr. Dyar, an *Acronycta*, the second and third I have referred to a distinct subgenus, *Merolonche*, but, after seeing the European *menyanthis*, it appears possible to me that *spinea* is congeneric or, at least, related. The bulk of the species are found over the temperate regions of the South American Continent, from Lower Canada to the Gulf; from New

England to Colorado. According to the classification of the larvæ, five subgroups are common to Europe and North America. Strictly "representative" species, true species of replacement, seem to be only *alni* and *funeralis*, *euphorbiæ* and *sperata*, *auricoma* and *impressa*, *leporina* and *vulpina*, while, although the moths are very near, the larvæ of *psi* (or *tridens*) differ rather decidedly from *occidentalis*, so that *psi tridens* and *occidentalis* appear rather as parallel species. The species referred to *Hybona* and *Triena* are very numerous in North America, the larvæ being more or less easily distinguishable, while the moths differ chiefly in their relative proportions, the *psi* pattern being repeated in *morula*, *occidentalis*, *hasta*, *furcifera*, *betulæ*, *grisea*, *tritona*, *quadrata*, *lobeliæ*, *radcliffei*. Peculiarly European groups are offered by those named by me *Apatela*, *Cuspidia*, peculiarly American are *Megacronycta*, *Philorgyia*, *Tricholonche* and *Lepitorea*. Taking all the groups in the synopsis as distinct, we have eight American, three European and five common to both faunæ, from larval characters alone.

Although in North America the genus *Apatela* offers peculiar outgrowths, so to speak, its affinity with the European is decided. We may therefore regard it as one of the survivors of a former holoarctic or circumpolar fauna, which would have been forced southwards, both in America and Asia, by the advent of the Glacial epoch. Traces of this European affinity are found in the moths of Japan, and has then the same origin. To the same shifting of the faunal extension, the sundering of species once occupying an extended territory, through climatological changes, we must ascribe the fact that the genus *Oreta* is found in Japan and North America. If my suspicion that the California *spinea* and the European *menyanthidis* are related is verified, it would be another link in the chain of facts which go to show that the Rocky Mountains have proven a barrier to the extension of certain types to the eastward. Conversely the Citheroniidæ occur only in the East. We find in California a true *Saturnia* and true or typical *Hypena*, together with Arctian and other types having a strong European facies. It seems natural to suppose that these have taken a west coast direction in the glacial movement to the south, and there now maintain themselves. The occurrence in Maine and Canada, north of the Great Lakes, of species of *Pyrausta* and *Agrotis*, which we know from British Columbia or northern parts of California, may be explained not only on the general principle of a southward migration over the whole territory, but possibly by the fact that inter-communication between the West and East meets to the northward in certain places less difficult

barriers. There is also the dependency upon food plants and geographical conditions to be considered. At any rate, the central California fauna must be studied from the point of view that it is isolated upon a comparatively narrow strip of land as compared with the fauna east of the main range. And this view must be taken of the fauna of the West Coast, both in North and South America, wedged in as it is between the sea and the mountainous backbone of the New World.

The very near relation between the moths of *psi*, *tridens* and *occidentalis*, while the larvæ are so strikingly different, recalls the case of *Datana* and *Phalera*, though here the larval characters are decidedly stronger and even structural. We may assume that here the tendency to split into distinct larval forms was early developed, and that it exemplifies the fact that specific characters in *Apatela* are best, perhaps first, expressed in the younger stages. The two European species seem altogether nearer, and lead to the impression that they have a more immediate connection, while the American probably left the common ancestor at the close of the Tertiary.

In 1894, Dr. Harrison G. Dyar discussed the appearance of the larvæ of *Apatela*, and his remarks are in part applicable to the European forms. The diversity is mainly ascribed to a "mimicry of all sorts of objects, from that of resemblance to the foliage (*grisea*, *tritona*), to warning colors (*oblinita*) and mimicry of special objects, such as spider's nest (*vulpina*) or of some other specially defended larva (*radcliffei* mimics *Datana*, or *luteicoma*, which probably mimics *Orgyia*)." Previously, in 1893, Dr. Chapman had discussed the mimicry of the larvæ as follows: "The protection which the full grown larvæ have from their enemies, owing to their special form and coloring, is a matter that in its details, has very largely eluded me; I have, in fact, seen very few *Cuspidia* in the wild state. *Psi* and *tridens* are usually conspicuous; *strigosa* no doubt closely assimilates to a hawthorn leaf with a bit of brown dead leaf or twig. My observations on *leporina* were made and repeated a good many times on the green white-haired form occurring on alder; this larva sits somewhat curled round, near the middle of the underside of a leaf. Looking down from above it is absolutely hidden, looking up from beneath it ought to be very evident, but this is far from being the case. I have several times missed a larva till I have looked three or four times, and have also fancied I saw a larva when none was there. In looking up from below through the foliage of an alder tree, most of the lower leaves are in the shade of the upper ones, but here and there a gleam of light falls through on to a

portion of a leaf, and gives it quite a different tone and appearance, as seen from beneath. A larva of *leporina* seated beneath an unilluminated leaf, precisely resembles one of these patches." It is the American representative of *leporina*, my *vulpina*, which Dyar fancies bears, in its position on the leaf, a resemblance to a spider's web. I have at one time fancied that the larva of *alni* and *funeralis*, had deterrent colors, but conclude that it is a case of mimicry. The black body resembles a wet twig, the creamy dorsal patches mould, while the spatulate hairs are like the filaments of club mosses. The somewhat slow and stealthy movement which I have noticed in this to me repulsive larva, adds to the deceptive likeness to these inanimate objects so common in the woods. The young larva of *alni*, resting in a curled position on the leaf above, seems to imitate in its colors bird excrement.

With regard to the mimicry of caterpillars we must remember that larvæ are exposed to the attacks both of vertebrates and invertebrates. Birds prey upon them, and they have every reason to fear the attacks of insect parasites. The law of vision may thus be assumed to be the same for the vertebrate as for the insect eye. Both the bird and the wasp must be deceived by the appearance of *alni* and of *funeralis*, and pass them over, if the mimicry is to be effective. It may be argued, from the unity in the manifestation of mimicry, no general indications being apparently offered, of mimicry working in two directions to meet different visual conditions in its enemies, that it succeeds both with the bird and the wasp in a percentage of instances. The original percentage, like the original variation was small, but sufficient to establish the original direction, and, once established, it is evidently worked out by heredity to the condition in which we now find it. To be effective with the wasp, as with the bird, the mimicry of *alni* must produce a similar effect upon the retina of both; in this case not only the form, but the color, must be seen, both together suggesting to the brain of bird and insect not the real, but a different, and, to them, indifferent object. The immunity is probably only the result of cursory examination, but even this is sufficient to justify the variation. So far as the larval groups in *Apatela* are established, they partly show a special direction in the means to secure immunity from their enemies. Thus the more typical forms of the subgenus *Hyboma* resemble foliage, while several species belonging to the genus *Pharetra* seem deterrent. The general neutral gray tint of the moths has been commented upon by authors as adapted to conceal them from observation in their usual resting places, in the crevices of the bark and against the trunks of trees. The moths which choose such resting

places in the daytime have generally gray or blackish, protectively colored primaries, of such neutral tints as to deceive the eye in passing rapidly over an extended surface. But in *Apatela* the direction of the mimicry, the object copied, differs in the larva and moth of the same species. The independent direction of the larval efforts in this respect is important evidence in sustaining the view that in metamorphosis the stages acquire characters useless to the succeeding, and that here the larva of *Apatela* has attained an independent perfection as regards ultimate peculiarities of adaptive structure applicable only to the conditions of its own particular stage.

CORRECTION OF THE TYPE OF AGRONOMA AND NOTE ON LASPEYRIA.

By A. RADCLIFFE GROTE, A. M.

It has been recently stated by Mr. John B. Smith that the type of *Agronoma*, given by me in the Bremen List, May, 1895, p. 23, viz: *vestigialis*, does not correspond in structure with *jaculifera*, the type of *Feltia*, inasmuch as the front is not roughened or tuberculate and the front pair of tibiae are not heavily armed. Still my reference of *Feltia* to *Agronoma* will hold. The material examined by me in Bremen in 1893-4, when writing the list, is no longer accessible to me and I am not sure what species I examined. But Hübner's genus *Agronoma* contains, beside *vestigialis*, both *crassa* and *exclamationis*. I have examined here, in the Roemer Museum, specimen of *crassa*. The fore tibiae are heavily armed, the front is roughened or tuberculate, the male antennae are pectinate. It is therefore a *Feltia*. Inasmuch as *vestigialis* is referred as belonging to *Agrotis* in a restricted sense, and as congeneric with the type *segetum*, as established by me and adopted by me in the "Revision," it follows that the type of *Agronoma* must be changed and *crassa*, the first species cited, is then the type. Hübner establishes *Agronoma* for species having the general aspect of *jaculifera*; the claviform is usually suffused with a darker color. Probably the European species *exclamationis*, *corticea*, *obesa*, *graslini* and *fatidica* belong to *Agronoma* and share the structure of *crassa*. The name of our common North American species will then remain, as claimed by me in the list: *Agrotis (Agronoma) jaculifera* Gn. Those using my Bremen List will please make the correction and I am much